



Comparative Demography and Life History of the Northern Diamondback Terrapin (*Malaclemys terrapin*) in the Chesapeake Bay

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Principal Investigator(s):

Paula F.P. Henry, Ph.D. paula_henry@usgs.gov
USGS Patuxent Wildlife Research Center, Beltsville Lab
c/o BARC-East, Building 308
10300 Baltimore Avenue
Beltsville, MD 20705

Collaborators: Chesapeake Bay Program (over 25 Federal Agencies, 6 States, the District of Columbia, and numerous local customers and partners)

Statement of Problem: The Diamondback terrapin is the only brackish water turtle species in the United States and as such, is a major constituent in the estuarine food web. There is great concern and public advocacy for the Northern diamondback terrapin across its North American range. The life history and reproductive cycle of the terrapin depend strongly on the availability of shoreline and offshore habitat for its resources. The terrapin exhibits delayed sexual maturation and relatively low annual recruitment. As such, its populations depend on strong juvenile and adult survivorship, and cannot tolerate long-term emigration or extended periods of high population mortality. Legislatively in 2003, the terrapin is listed as a Species of Concern in only 3 states, and remains commercially harvested in NY, NJ, NC, GA, FL, AL, LA and MD. Should additional pressure be exerted from international markets as is observed with other turtles, or from by-catch mortality from increased crabbing and fishing harvests, terrapin population levels may decline rapidly. For its long-term population survival and conservation, high quality, objective information is needed on the terrapin's sensitive life stages, its biology, potential and current environmental hazards, and assessments of some proposed 'protective' measures.

Objectives: Collect data on nesting behavior, life history, ecology, habitat preferences and demographic statistics from terrapins using beach and offshore sites differentially managed or representing distinct land use practices; obtain estimates of population structure and size, survivorship, and movement throughout the Bay; develop protocols and index sites for establishing a monitoring program on the status of the terrapin population.

Approach:

Nesting habitat study

The eastern and western shorelines along the MD Chesapeake Bay and major tributary rivers were surveyed to detail the distribution of diamondback terrapin nesting sites. Sites were characterized according to substrate type, extent of available back beach, and their proximity to shoreline stabilization structures and land development. Nest density and activity were monitored at a subset of beach areas. A spatial analysis was conducted using GIS layers on urban developed and protected areas, differential land-use maps, and USGS 2002 and 2003 terrapin nesting data. High protection priority sites were defined based on current terrapin nest site distribution and possible risks turtles might face if further urban development continues. Analyses were conducted on a limited geo-range of the Bay. Similar spatial analyses over larger tracts of the Bay would allow managers to continually update risk analyses and effectively monitor critical wildlife habitat. Findings were presented at Society of Conservation Biology, July 2004 (poster D. Schweitzer and P. Henry)

Conservation genetics

Samples were submitted from 12 sites in the Chesapeake Bay to test whether the *M. terrapin* inhabiting Chesapeake Bay comprise a single homogeneous population. The DNA analyses are being analyzed by Dr. Tim King of the USGS Leetown Science Center. Preliminary analyses indicate a greater than anticipated rate of gene flow; additional samples are being submitted to further delineate findings.

Distribution and population viability

In 2003, mark release recapture techniques were applied in a series of population studies. Studies were initiated at 2 sites along the Maryland Eastern shore: an upper Bay site at Eastern Neck National Wildlife Refuge characterized by extensive agricultural and residential development and a lower Bay site at Martin National Wildlife Refuge, Smith Island, characterized as a remote, pristine salt-marsh environment. Data on population size, structure, and age-class specific survivorship estimates are being monitored over a 3-5 year period at the 2 sites. Over 2700 terrapins have been successfully tagged and released as of August 2004.

Food resource utilization

Very little information is known of the resource needs of the subadult terrapins (<8 years). As part of the population studies at the 2 sites, young terrapins have been successfully trapped deep within the Martin NWR island marsh to investigate seasonal resource needs and use. Tissues samples are collected monthly to be submitted for stable-isotopic analysis ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{14}\text{N}$) of the principal components of the subadult terrapin's seasonal diets.

Measures of environmental hazards.

Remote sensing methods are being developed to study the influence of habitat and land use practices on the incidence of nest predation. Such indices of predation pressure will be applied to complete recruitment estimates for the nesting data collected in 2002/03 across >60 sites along the eastern shore.

To address the relative sensitivity to contaminants and other environmental stressors, a physiologically based biomarker profile of the terrapin at 3 stages of development and sex is being developed. This reference will provide biochemical, endocrine, and immunological measures and range of response of terrapins under control (background) conditions, and be made available as a useable database. Response variables will be used to measure the relative sensitivity of terrapins chronically exposed to sublethal contaminants.

Selected Reports and Other Products:

Exhibits, Delivered: Diamondback Terrapins in the Chesapeake Bay National Wildlife Refuge System Centennial and Blackwater National Wildlife Refuge 70 years: Blackwater NWR Cambridge, MD (2003)

Posters, Delivered: Schweizer, D., and Henry, P., GIS assessment of terrapin turtles nesting areas in need of protection in the Chesapeake Bay, MD. Delivered to the Annual Society of Conservation Biology (2004); the Society of Environmental Journalists 12th Annual Conference, Baltimore, MD (2003); the USGS Chesapeake Bay Meeting, St. Michaels, MD (2003); and the USGS Northeastern Coastal Ecosystems and Resources Workshop Bay Campus, University of Rhode Island, Narragansett, RI (2003)

Presentations, Delivered: Invited Presentation on USGS research on Diamondback terrapin. Delivered to the Marine Traders Owners Association, Somers Cove Marina, Crisfield, MD (2002), and at the USGS Chesapeake Bay Meeting, National Wildlife Visitor Center, Laurel, MD (2002)

Poster Planned: Third Workshop on the Ecology, Status, and Conservation of Diamondback terrapins, Sept. 2004: Haramis, G.M., Henry, P., Day, D., Use of a traditional harvest method to sample Diamondback terrapins in winter in Chesapeake Bay

Poster, Planned: Henry, P., Day, D., and Haramis, G.M., Population study of the Diamondback terrapin in the MD portion of the Chesapeake Bay

Poster, Planned: Barrios, J., and Henry, P., Nest predation on Northern diamondback terrapin by small carnivores at Eastern Neck NWR, MD.

Report, Delivered: The distribution and status of the Diamondback terrapin (*Malaclemys terrapin*) in the Chesapeake Bay; Patuxent Wildlife Research Center Science Brief for Resource Managers - May 2002; Patuxent Wildlife Research Center Science Brief for Resource Managers - January 2003

Relevance and Benefits: It is anticipated that the data generated will provide a baseline for research initiatives: the nutritional effects of changes in the dominant food base of the terrapin; the impact of traditional and innovative wildlife protective - restoration projects on terrapin; and the relative contribution to the populations by those few, but highly visible, terrapins nesting in parking lots. Developing and building up a monitoring protocol for the Bay that takes into account variables due to the diverse and rich habitat of the Bay, and the biology of the species, can be a centralized starting point for future

research activities. Relating the monitoring data to information transfer through a dynamic and user-friendly GIS should help build collaborative research from different areas of expertise, thereby help obtain a better understanding of the status of the terrapin. This approach should also maximize the information that is critically needed to understand the terrapin better, and to generate appropriate multi-species management plans. Terrapins have generated a lot of public concern for the turtle and awareness of the uniqueness of the Bay's resources. Many of the risk factors affecting the health of the Chesapeake Bay (e.g. decreased water quality, declining SAV, pollutants, marsh and shoreline loss, environmental impacts from increased recreational and commercial activities) potentially directly or indirectly affect the terrapin's survival and well being in the Bay.